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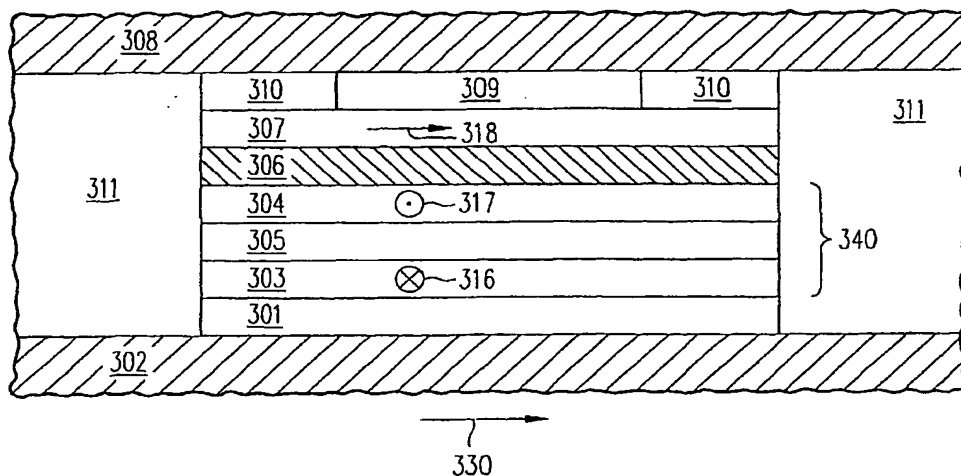
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(54) Title: **TUNNEL JUNCTION AND CHARGE PERPENDICULAR-TO-PLANE MAGNETIC RECORDING SENSORS AND METHOD OF MANUFACTURE**



(57) Abstract: Magnetic tunnel junction (MTJ) and charge perpendicular-to-plane (CPP) magnetic sensors are disclosed which have a first antiferromagnetic layer for pinning the magnetization direction in a pinned layer and a second antiferromagnetic layer for providing bias stabilization of a free layer. The two antiferromagnetic layers may be formed from the same material and using a spin-flop effect may be initialized simultaneously. A disk drive using these sensors is disclosed.

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INTERNATIONAL SEARCH REPORT

National Application No

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01R33/09

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01R G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 768 069 A (MAURI DANIELE) 16 June 1998 (1998-06-16) column 2, line 9 - line 38 figures 1-8	1-13
Y	US 6 137 662 A (HUI YIMING ET AL) 24 October 2000 (2000-10-24) abstract column 4, line 57 - column 6, line 34 figures 5-8	1-13
Y	US 6 097 579 A (GILL HARDAYAL SINGH) 1 August 2000 (2000-08-01) column 6, line 7 - line 44 figures 1-5	1-13
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	REDON O ET AL: "EXTRA CURRENT CHANNELS IN LONGITUDINALLY BIASED MAGNETIC TUNNEL JUNCTIONS" JOURNAL OF APPLIED PHYSICS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 87, no. 9, 1 May 2000 (2000-05-01), pages 4688-4690, XP000947665 ISSN: 0021-8979 the whole document -----	1-13
A	US 6 023 395 A (LIN TSANN ET AL) 8 February 2000 (2000-02-08) column 5, line 65 -column 7, line 52 figures 1-6 -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5768069	A	16-06-1998	KR 263011 B1 SG 53113 A1 US 5856897 A	01-08-2000 28-09-1998 05-01-1999
US 6137662	A	24-10-2000	JP 11316918 A	16-11-1999
US 6097579	A	01-08-2000	NONE	
US 6023395	A	08-02-2000	NONE	